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(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 321 908**  
**A2**

(12)

# EUROPEAN PATENT APPLICATION

(21) Application number: 88121238.5

(51) Int. Cl.<sup>4</sup>: **A61L 2/20**

(22) Date of filing: 19.12.88

(30) Priority: 23.12.87 JP 326287/87.

(43) Date of publication of application:  
28.06.89 Bulletin 89/26(64) Designated Contracting States:  
DE FR GB

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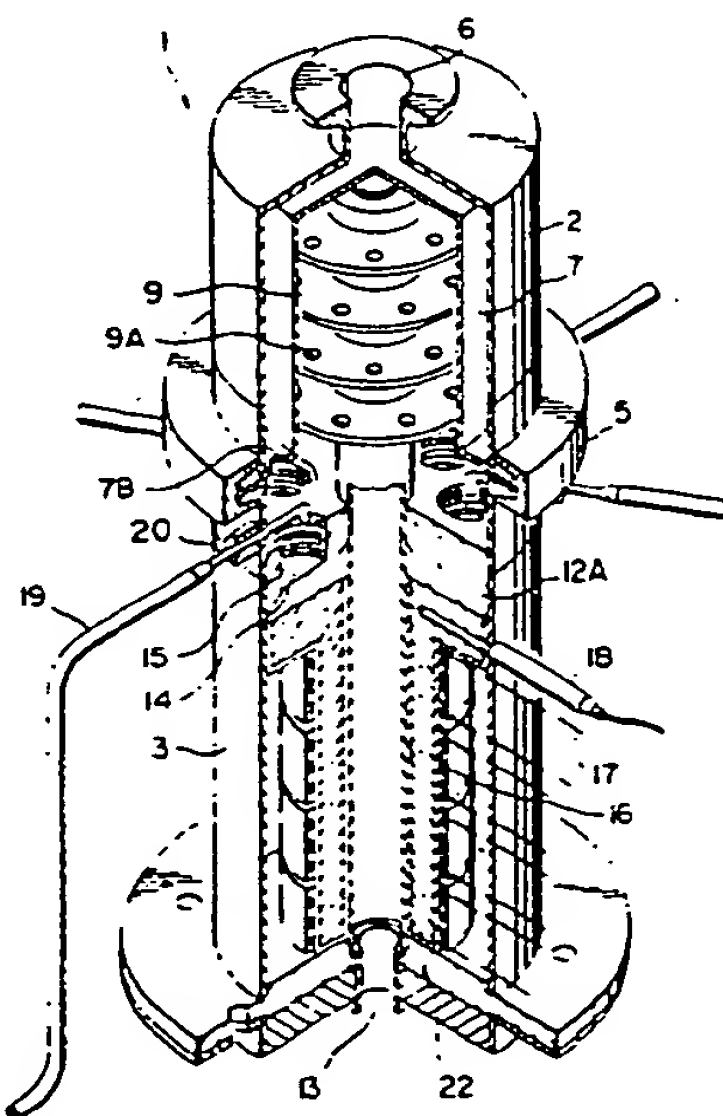
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(54) Disinfectant vaporizing apparatus.

(57) A disinfectant vaporizing apparatus for dropping disinfection liquid on a heating unit and providing uniform disinfection gas on a surface of a material to be sterilized which characterized in that at least one supply port for supplying heated carrier gas at high temperature for the disinfection gas is provided in a vaporization chamber for the disinfectant in which at least one dished vaporization part provided on an upper surface of an evaporation unit and at least one dropping nozzle is provided thereabove, respectively, wherein the disinfection gas carried by the heated carrier gas is applied on a surface of a material to be sterilized through a droplet splash removing apparatus.

Fig. 1



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## DISINFECTANT VAPORIZING APPARATUS

### BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for vaporizing a disinfectant by dropping it on a heating element, which apparatus is applied to such a technical field that, when a packing material including a container or the like is sterilized or disinfected by using disinfection gas, a material to be sterilized is sterilized by dropping a disinfection liquid on the heating element to vaporize, introducing the vaporized infection gas to the surface of the material to be sterilized by a heated carrier gas and condensing the carried disinfection gas on the surface of the material to be sterilized by a heated carrier gas and condensing the carried disinfection gas on the surface of the material to be sterilized.

Heretofore, there is disclosed in the above-mentioned technical field using hydrogen peroxide as a disinfection gas, a spray vaporization method using spray or the like. According to said spray vaporization method, it is necessary to provide a system for pressurizing hydrogen peroxide and a spray chamber. Some trouble in process such as blinding of nozzles and hunting of spray is probable to occur.

Therefore, Japanese Patent Application 174235/86 is proposed by the present applicant. The application adopts a drop vaporization method in which hydrogen peroxide is vaporized by dropping it on the heating unit and a board heating type or a falling heating type is proposed as the construction of said heating unit.

That is, according to the board heating type unit, a stainless net is provided on a heat transfer block as an evaporation surface, a blow-off opening for a heated carrier air is provided above the evaporation surface parallel to the surface of the heat transfer block, the heated air is blown from the opening to promote the evaporation of hydrogen peroxide and the hydrogen peroxide gas is carried. A filter means is provided adjacent to the outlet of the vaporization chamber so as to prevent droplet splashes of hydrogen peroxide caused by increase of the carrier air or by the spheroidal phenomenon on the heated surface from being accompanied with the hydrogen peroxide gas.

Referring now to the falling heating type unit, a stainless net is provided as a vaporization surface in a vertical double heat pipe, a blow-off opening for heated carrier air is provided below said double heat pipes and the heated air is blown up along the interval between the double heat pipes. Other features are substantially same as those of the board heating type unit previously explained.

In general, the drop vaporization method presents some difficulties in controlling the rate of supply of the material to be sterilized to the sterilizing apparatus and the drying conditions of the material to be sterilized, unless the hydrogen peroxide gas not accompanied with the droplet splashes can be supplied on the surface of the material to be sterilized. That is, if the droplet splashes of hydrogen peroxide exists with the hydrogen peroxide gas, the gas density thereof becomes uneven, resulting in uneven sterilization of the surface to be sterilized. In order to overcome the above disadvantages, there should be provided a means for controlling the rate of supply of the material to be sterilized in accordance with the gas density or a means for controlling the drying temperature, the drying velocity or the like in the drying process of the material to be sterilized. With this, however, the control of the sterilization becomes complex.

The above disadvantages have not yet overcome by the apparatus for vaporizing hydrogen peroxide liquid by dropping it on the heating unit, as disclosed in said Japanese Patent Application 17425/86. That is, according to said Japanese Patent Application 17425/86, because the board heating type unit thereof has the stainless net provided above the heat transfer block in the shape of the plate as the evaporation surface, the area to be heated spreads horizontally wide and therefore occurs uneven heating and thermo difference in some heated surfaces. With this, the gas density also becomes uneven and uniform supply of hydrogen peroxide as the disinfection cannot be conducted.

Further, The hydrogen peroxide which is not evaporized because of the uneven heating often accumulates at the bottom of the apparatus. Further there also occurs large heating loss caused by the large heating area. Additionally, the prior filter means for preventing the drop splash of hydrogen peroxide accompanied with the hydrogen peroxide gas, is not sufficient enough to make the vaporized hydrogen peroxide gas uniform.

Further according to the falling heating type disclosed in said Japanese Patent Application 174235/86, the heated surface is also large, however it spreads vertically, and therefore it leaves same disadvantages as those of the board heating type unit.

### SUMMARY OF THE INVENTION

Accordingly the object of the present invention is to provide a disinfectant vaporizing apparatus for dropping disinfection liquid on a heating unit and

for providing uniform disinfection gas on a surface of a material to be sterilized. According to the present invention, there is provided a disinfectant vaporizing apparatus which characterized in that at least one supply port for supplying heated carrier gas at high temperature for disinfection gas is provided in a vaporization chamber 8 for the disinfectant in which at least one dished vaporization part 14 provided on an upper surface of an evaporation unit 12 and at least one dropping nozzle is provided thereabove, respectively, wherein the disinfection gas carried by the heated carrier gas is applied on a surface of a material to be sterilized through a droplet splash removing apparatus.

The droplet splash removing apparatus is not limited to shield plates or filter means only and any means which can remove droplet of the disinfection gas can be used. For the disinfectant, liquid disinfectant such as hydrogen peroxide, alcohol or the like can be used.

For the heated carrier gas, not only hot air but also inlet gas, mixed gas of inlet gas and air or the like can be used.

The operation of the disinfectant vaporizing apparatus according to the present invention will be described hereinafter based on Fig. 2. The pre-heated carrier gas at high temperature is applied to the disinfectant vaporizing apparatus from an inlet port 6. The heated carrier gas lowers along the interval between an upper outer cylinder 2 and an inner cylinder 7 to reach an evaporation chamber 8 through an opening 7B.

On the other hand, disinfectant applied from a quantitative supply apparatus is dropped on a dished vaporization part from a dropping nozzle 20 through a supply tube 19. An evaporation unit 12 is heated by a heater means 16. Because the dished vaporization part is heated by heat transmitted through the outer or inner surface of the evaporation unit 12, the drop of the disinfectant dropped on the dished vaporization part is heated to evaporate.

When heating temperature of the disinfectant drop becomes over a predetermined temperature, a membrane appears between the drop and the evaporation surface to subject to float droplet particles and while the coefficient of heat transfer decreases, the evaporation time increases, namely spheroidal phenomenon occurs. Therefore, a cylindrical net 15 may be provided about the surrounding of the dished, for example concaved cylindrical evaporation part 14. With this, the drop is broken into parts by the cylindrical net 15, resulting in shorter evaporation time.

Disinfection gas heated and vaporized on the dished evaporation part is carried to an opening of an upper inner tube 10 through a droplet splash removing apparatus, accompanied with the heated carrier gas.

When the droplet splash removing apparatus provided with plural shield disks arranged to form stairs, which disks provided with plural holes, is used, holes adjacent to each other of said plural holes 9A of said shield disk 9 should be arranged staggeringly, additionally the plural holes provided on the plural shield disks 9 adjacent to each other should be arranged not to overlap each other to the vertical direction. Then the mix gas of the disinfection gas and the heated carrier gas rise snakingly or swirlingly. And the dropwise or splashwise disinfectant cannot rise therewith and combine each other into large drop, resulting in falling. Further since the mix gas of the disinfection gas and the heated carrier gas is snaked or swirled, the resulting mix gas has a uniform density.

The mix gas of the disinfection gas and the heated carrier gas carried to the opening of the upper inner tube 10 from the drop splash removing apparatus descends through the upper inner tube 10 and the lower inner tube 11 to be supplied to the disinfection apparatus directly from an exhaust port 13 or through an induction pipe ( not shown ).

The apparatus according to the present invention has following advantages. Since the surface area of the evaporation part is smaller compared with the well-known unit, there are no uneven heating, no accumulation of the disinfectant such as hydrogen peroxide at the bottom of the evaporation part and no heating loss.

Further, since the surface area of the evaporation part is small, the control of the temperature of the evaporation part has become easier.

Additionally, since, when the surface area of the evaporation part is small and shield plates are provided above the evaporation part as a drop splash removing apparatus, the dropwise or splashwise disinfectant cannot rise and it combines each other into large drop, resulting in falling, uniform disinfection gas accompanied with the heated carrier gas can be supplied on the surface of the material to be sterilized.

Furthermore, the apparatus is compact enough as an evaporation means and it can easily be demounted in respect to maintenance and therefore has high high economical effect.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and the other objects of the invention will be seen by reference to the description taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view including partial sectional view showing one embodiment according to the present invention using hydrogen peroxide as a disinfectant.

Fig. 2 is a sectional view showing the operation of the apparatus of Fig. 1.

Fig. 3 is a partial view of the evaporation unit, and

Fig. 4 is an explanatory view with respect to the concaved cylindrical evaporation part.

## DESCRIPTION OF THE INVENTION

Referring to the drawings, as shown in Figure 1, 4 reference numeral 1 is a hydrogen peroxide vaporizing apparatus comprising an upper outer cylinder 2 and a lower outer cylinder 3. A flange 2A is provided in the lower surface of the upper outer cylinder 2 and a flange 3A is provided in the upper surface of the lower outer cylinder 3. A packing 4 is provided between the flanges. A ring 5 having concaved cross section is removably mounted to cover the flanges. An inlet port 6 is arranged on the upper portion of the upper outer cylinder 2. An inner cylinder 7 is provided inside the upper outer cylinder 2, which inner cylinder 7 has a flange 7A at the lower portion thereof and the periphery of the flange 7A is arranged to fit between a cutout portion 2B of the flange 2A and the inner periphery surface of the flange 3A. A hole 7B is provided in the flange 7A, with this, the carrier hot air is discharged to a vaporization chamber 8. The vaporization chamber 8 of hydrogen peroxide is determined by the flange 7A, an evaporation unit 12 and the lower outer cylinder 3. The profile of the vaporization chamber of the present invention is not limited to the above construction. Shield disks 9 are provided in an upper inner tube 10 inside the inner cylinder 7 and a stairs construction is formed by the plural shield disks 9. Plural holes 9A are provided on the shield disks 9, which holes adjacent to each other are arranged staggeringly and the plural holes of the plural shield disks are arranged not to overlap each other to the vertical direction. The arrangement of the plural holes adjacent to each other and the arrangement of the holes of the plural shield disks are not limited to the above described arrangement and any construction in which the mix gas of the hydrogen peroxide gas and the carrier hot air can rise snakingly or swirlingly can be applied. Further the shield plate is not limited to the disk-like shield. The drop splash removing apparatus is not limited to the construction in which the plural shield plates provided with the plural holes are arranged to form stairs and any means for removing the drop of the disinfection gas can be used and not only the shield plate but also a filter means or an agitation wing means or the like can be also applied.

The upper portion of the upper inner tube 10

opens to the upper inner surface of the inner cylinder 7 and a lower inner tube 11 is connected with the lower portion of the upper inner tube 10. The lower inner tube 11 passes through an inner path 12C of the evaporation unit 12C and an exhaust port 13 for the carrier hot air is provided in the lower portion of the lower inner tube 11.

On the other hand, the evaporation unit 12 is provided inside the lower outer cylinder 3, which evaporation unit 12 comprising an upper cylinder portion 12A and a lower cylinder portion 12B having a diameter less than that of the upper cylinder portion and the inner path 12C is vertically provided in the inner side of the upper cylinder portion 12A and the lower cylinder portion 12B. Plural concaved cylindrical vaporization part 14 are provided on the upper surface of the cylindrical portion 12A. As described in Fig. 4, a cylindrical net 15 is provided about the surrounding of the concaved cylindrical vaporization part 14. The vaporization part 14 is not limited to the concaved cylindrical unit, any dished unit can be applied. Plural heaters 16 are arranged to form stages in the lower cylinder portion 12B and lead wires 17 are connected with the heater 16. A space 22 is provided below the concaved cylindrical vaporization part 14 inside the evaporation unit 12 and a thermo sensor 18 is inserted to the upper portion thereof from the outside of the lower outer cylinder 3.

A vaporization condition can be measured by the thermo sensor 18 substantially equal to the condition of the concaved cylindrical vaporization part 14. In the part of the space 22 belonging to the upper cylinder portion 12A, it can be filled with a filler having good coefficient of thermal conductivity and also it can be integrally molded with the same material as the evaporation unit 12. In this case, as described in Fig. 3, the space of the upper cylinder portion 12A is used only as a hole for the thermo sensor. In the part of the space 22 belonging to the lower cylinder portion 12B, heat insulating material 21 is filled.

The hydrogen peroxide liquid is supplied from a quantitative apparatus ( not shown ) through plural supply tubes 19. As described in Fig. 4, dropping nozzles 20 are connected with the end of the supply tube 19 and each dropping nozzle passes through the lower outer cylinder 3 and is turned down above the concaved cylindrical vaporization part 14.

While the invention has been particularly shown and described with reference to preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details can be made therein without departing from the spirit and scope of the invention.



## Claims

1. A disinfectant vaporizing apparatus which characterized in that at least one supply port for supplying heated carrier gas at high temperature for disinfection gas is provided in a vaporization chamber for the disinfectant in which at least one dish vaporization part provided on an upper surface of an evaporation unit and at least one dropping nozzle is provided thereabove, respectively, wherein the disinfection gas carried by the heated carrier gas is applied on a surface of a material to be sterilized through a droplet splash removing apparatus.

2. A disinfectant vaporizing apparatus according to claim 1, wherein the droplet splash removing apparatus includes a droplet splash removing means provided above the vaporization chamber, which means has plural shield plates arranged to form stairs and plural holes are provided on each shield plates.

3. A disinfectant vaporizing apparatus according to claim 2, wherein holes adjacent to each other of the plural holes provided on the shield plate of the droplet splash removing means are arranged staggeringly.

4. A disinfectant vaporizing apparatus according to claim 2, wherein the plural holes provided on the plural shield plates arranged to form stairs are arranged in such a manner that the plural holes do not overlap to the vertical direction.

5. A disinfectant vaporizing apparatus according to claim 1, the droplet splash removing apparatus includes a droplet splash removing means provided above the vaporization chamber and which means uses a filter means.

6. A disinfectant vaporizing apparatus according to in any one of claims 1 to 5, the dished vaporization part has a concaved cylindrical shape and a cylindrical net surrounding the side surface thereof.

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Fig. 1

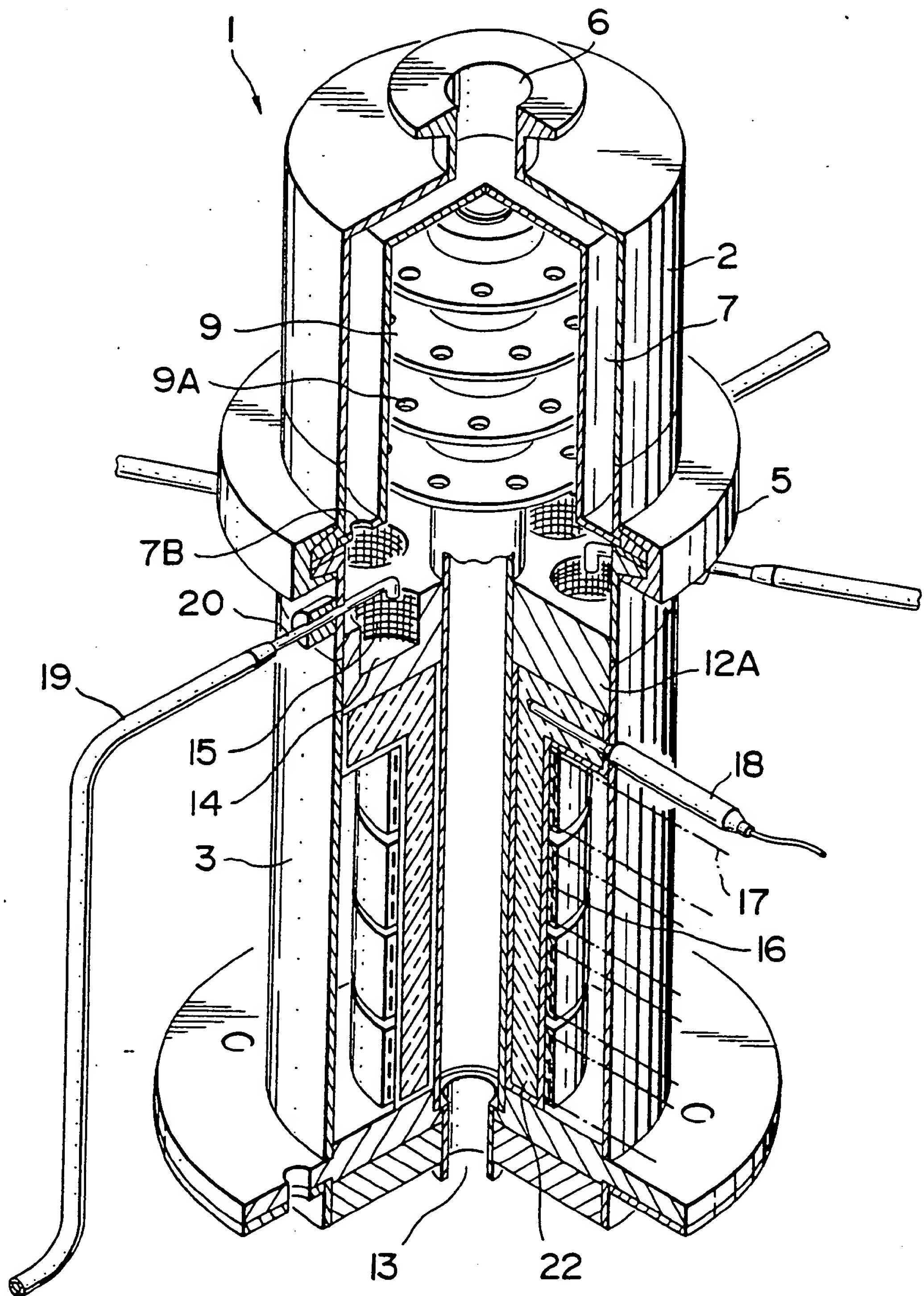


Fig. 2

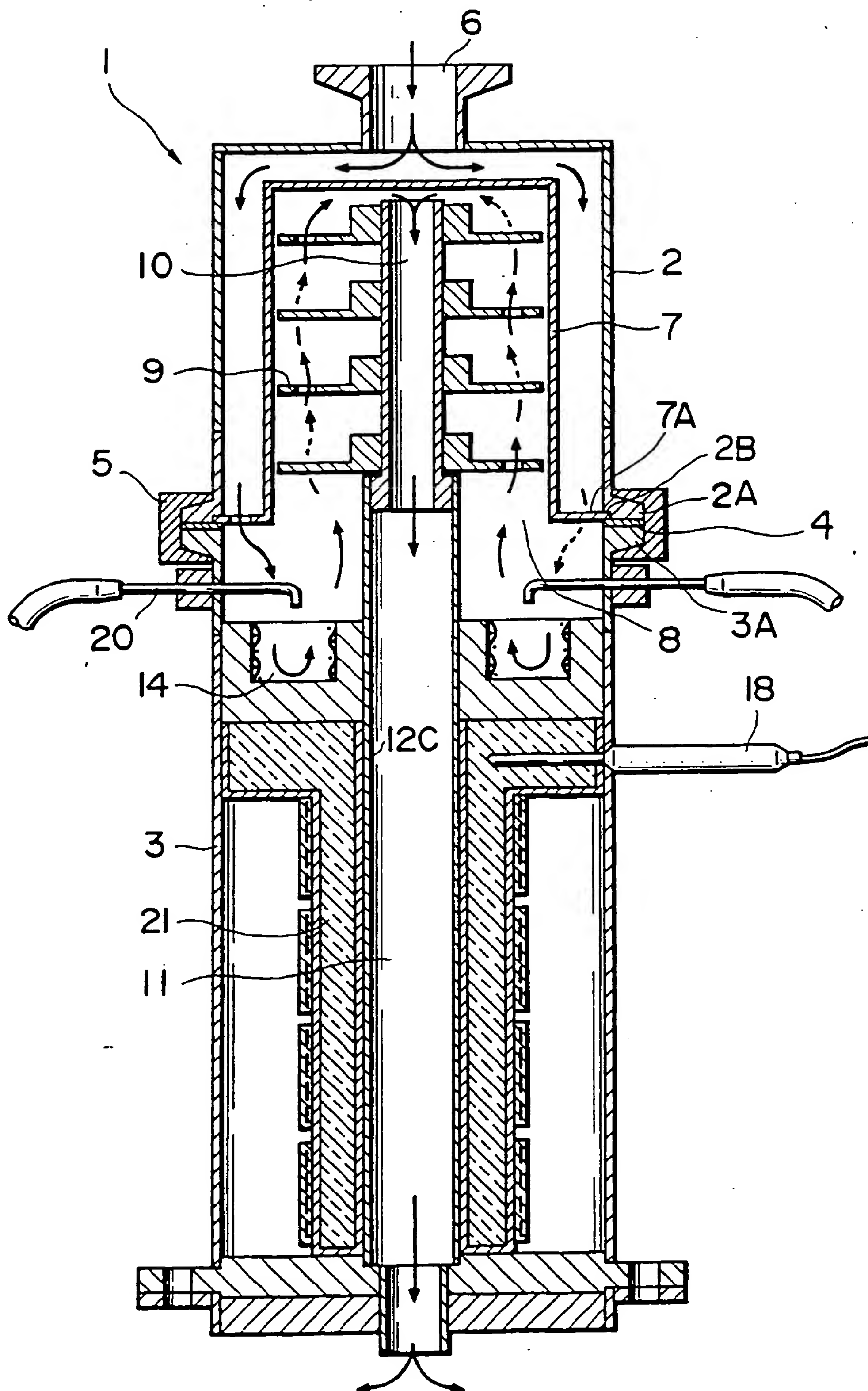




Fig. 3

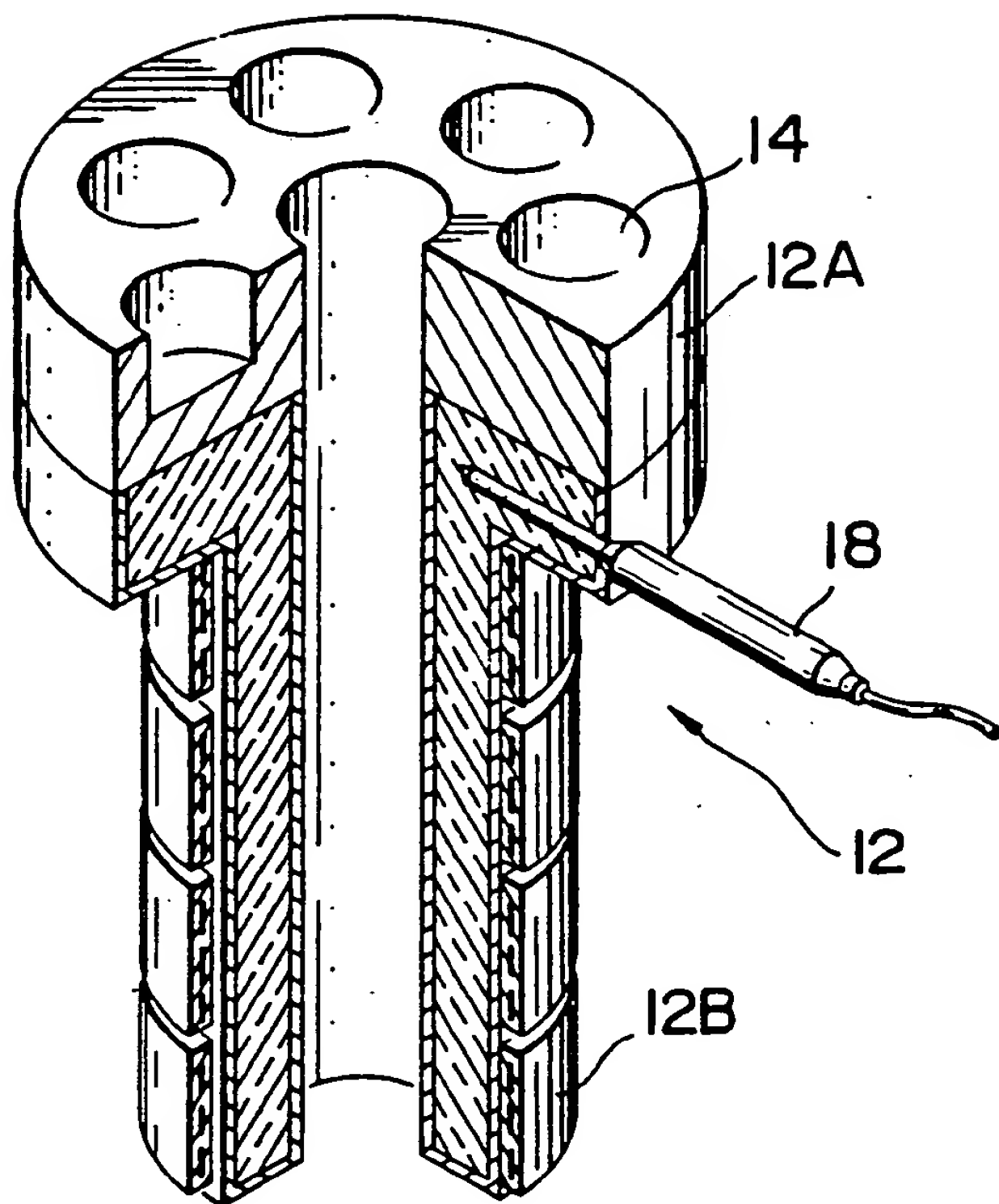
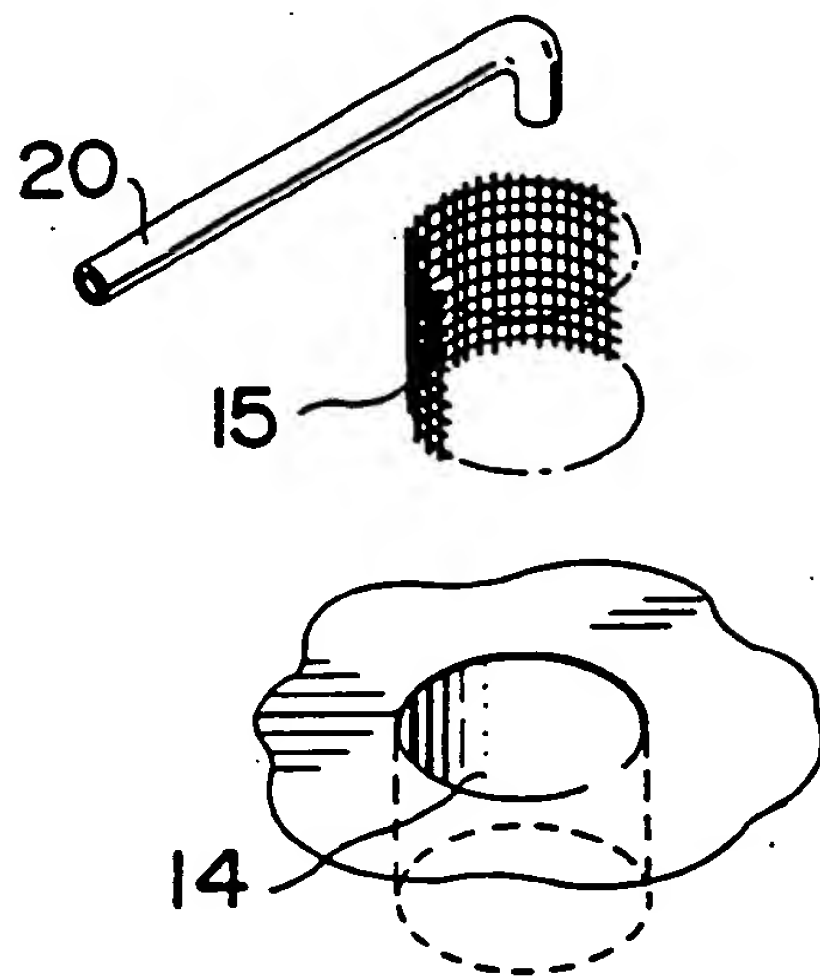


Fig. 4





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Publication number:

**0 321 908**  
**A3**

(12)

## EUROPEAN PATENT APPLICATION

(21) Application number: 88121238.5

(51) Int. Cl.<sup>5</sup>: **A61L 2/20**

(22) Date of filing: 19.12.88

(30) Priority: 23.12.87 JP 326287/87

(43) Date of publication of application:  
28.06.89 Bulletin 89/26

(84) Designated Contracting States:  
**DE FR GB**

(58) Date of deferred publication of the search report:  
21.03.90 Bulletin 90/12

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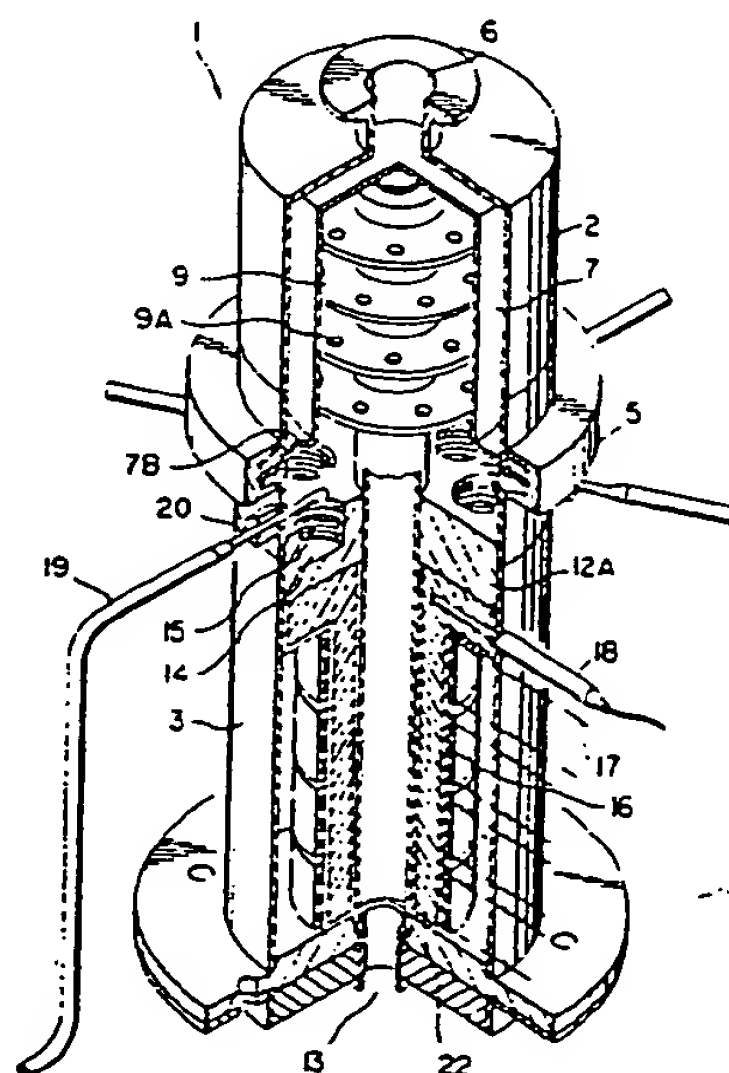
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(57) A disinfectant vaporizing apparatus for dropping disinfection liquid on a heating unit and providing uniform disinfection gas on a surface of a material to be sterilized which characterized in that at least one supply port for supplying heated carrier gas at high temperature for the disinfection gas is provided in a vaporization chamber for the disinfectant in which at least one dished vaporization part provided on an upper surface of an evaporation unit and at least one dropping nozzle is provided thereabove, respectively, wherein the disinfection gas carried by the heated carrier gas is applied on a surface of a material to be sterilized through a droplet splash removing apparatus.

Fig. 1



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# EUROPEAN SEARCH REPORT

Application Number

EP 88 12 1238

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Y	EP-A-0 114 619 (TETRAPAK) * Claims; figure 1 * ---	1-6	A 61 L 2/20 B 01 D 1/00
Y	GB-A- 392 044 (MANUFACTURE DE MACHINES AUXILIAIRES POUR L'ELECTRICITE & L'INDUSTRIE) * Column 2, lines 83-97; figure 1 * ---	1-6	
A	EP-A-0 141 533 (PALL CORP.) * Figure 1 * -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			A 61 L B 01 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-12-1989	Examiner COUSINS-VAN STEEN G.I.L.
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